

# Metacalibration: a method for directly estimating and calibrating biases in shears from real data

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(on behalf of collaborators Eric Huff,  
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d(shear)



d  

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d(systematic)

The goal: Determine the response of the entire shear pipeline to systematics, for a fully realistic galaxy population (no external simulations)

1. *Deconvolve*  
the PSF from the data image.

2. *Shear*  
the de-convolved data image

3. *Re-convolve*  
to a new, slightly larger PSF.

4. *Re-run*  
the entire pipeline.

These steps reveal Fourier modes that were hidden by PSF.

Reconvolution to a slightly larger PSF is necessary to hide these.

Measured shear response is only valid for larger PSF.

# MetaCalibration's virtues

- It calibrates the shear for the real galaxy population (by design)
- Includes a realistic PSF and noise field
- Can wrap any shape- or shear-estimation method
- It automatically accounts for selection biases

This is complementary to other approaches, avoids some of their limitations, and can be used for cross-validation

# What about systematics?

- MetaCalibration was initially intended to get the shear calibration (i.e., response of shear estimator to a shear of a given size)
- Then we realized that we could also test the response of the shear estimator to certain systematics after step (3) – at the expense of more resimulations.
  - Simple example: including bad columns.
  - More complex re-simulation is possible, at the expense of modifying the noise field (which can be fixed)

# Open questions

- For what sensor effects can this approach be used?
- For what sensor effects would this provide a useful complement to independent forward-simulation?